

PROMOTING INTERDISCIPLINARY RESEARCH WITH DATA SCIENCE IN VIETNAMESE UNIVERSITIES: CURRENT SITUATION AND ORIENTATION

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Abstract: *The integration of data science into interdisciplinary research (IDR) has become a cornerstone in addressing complex global challenges, particularly in the digital era. In Vietnam, while there has been a growing recognition of data science's potential, its integration into interdisciplinary research remains in the nascent stages. This paper examines the current situation of interdisciplinary research with data science in Vietnamese universities, identifying key challenges and opportunities. The study highlights the importance of infrastructure development, human capital, and collaborative frameworks to promote data science across academic disciplines. It also provides strategic recommendations for fostering a data-driven research ecosystem, ensuring sustainable development and global competitiveness. The paper concludes by proposing actionable steps for Vietnam to establish itself as a leader in interdisciplinary data science research, contributing to solving pressing societal issues.*

Keywords: *academic collaboration, data science, interdisciplinary research, interdisciplinary collaboration, university research*

I. Introduction

In the modern era, data science has increasingly emerged as a transformative field, enabling new methodologies and insights that cross traditional disciplinary boundaries. This interdisciplinary approach allows for tackling complex, multifaceted problems, which single-disciplinary research may struggle to

address. In Vietnam, the application of data science in research is still developing, with significant efforts to promote its integration into various academic fields. Despite recent progress, challenges such as inadequate infrastructure, lack of trained personnel, and fragmented collaboration between disciplines remain prevalent. This paper aims to explore the

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current state of interdisciplinary research in Vietnam. It discusses the necessity of promoting data science in Vietnamese universities, the barriers hindering this integration, and the potential benefits for societal development. The paper also identifies key strategies to enhance interdisciplinary collaboration and data science education in Vietnam.

II. Literature review

2.1. *Data science and interdisciplinary research*

Data science has emerged as a rapidly growing field that integrates a broad array of methods and tools for extracting knowledge and insights from large datasets. Data science combines statistical analysis, machine learning, and domain-specific expertise to process and analyze large, complex data sets, making it a critical tool for decision-making and problem-solving across industries. In the digital age, where data is produced at an unprecedented rate, data science has become an essential method for gaining insights into diverse domains such as healthcare, finance, agriculture, and social sciences.

Data science differs from traditional disciplines like statistics and computer science by emphasizing not just data analysis and inference, but also the use of algorithms to predict future trends and automate decision-making processes. This shift is exemplified in the field's focus on *predictive modeling* and *big data* analysis, which allows for real-time decision-making and the automation of various systems. For instance, in healthcare, data science can enable predictive analytics for disease outbreaks or the personalization of treatments based on genetic information.

Interdisciplinary research (IDR) is a collaborative approach that integrates methods, concepts, and frameworks from two or more disciplines to address complex research questions that cannot be fully understood from a single disciplinary perspective (Repko & Szostak, 2021). It is distinct from multidisciplinary research, where different disciplines contribute separately without necessarily integrating their approaches or findings. In contrast, interdisciplinary research fosters deep collaboration and synergy, allowing researchers to combine the strengths of multiple fields to innovate and develop new methodologies, perspectives, and solutions. Recently, data science in promoting interdisciplinary research has been widely used to solve complex, real-world problems. For example, in the context of climate change, data scientists collaborate with environmental scientists to create models that predict environmental impact.

In the global context, numerous academic institutions and research organizations have embraced data science as a central element of interdisciplinary collaboration. For instance, the Alan Turing Institute in the UK and the Data Science Institute at Columbia University have successfully facilitated cross-disciplinary partnerships that advance research in various fields such as health, engineering, and social sciences (González et al., 2020). In Vietnam, data science is increasingly recognized as an essential tool for addressing national development challenges, including in sectors such as agriculture, education, and healthcare. However, the integration of data science with other academic disciplines remains in its early stages compared to more

developed countries. According to a report by the Vietnam National University (2019), there has been significant investment in developing data science programs in major universities, but interdisciplinary collaboration between data science and other fields remains limited. Vietnam's recent efforts in fostering interdisciplinary research with data science are seen in initiatives such as VinGroup's research programs in areas like healthcare, smart cities, and agriculture, where data-driven technologies are used to enhance operational efficiency and decision-making (Vietnam Science and Technology Institute, 2020). However, these efforts have yet to evolve among research programs that span multiple academic and professional domains.

The challenges of integrating data science into interdisciplinary research in Vietnam include a shortage of highly trained personnel with dual expertise in data science and domain knowledge, as well as institutional barriers that hinder cross-departmental collaboration (Nguyen et al., 2021). To overcome these challenges, universities and research organizations in Vietnam are increasingly recognizing the need to adopt data science not only as a standalone discipline but as a shared infrastructure for interdisciplinary inquiry.

2.2. Data science in interdisciplinary research

Data science, as an interdisciplinary field, provides powerful tools and methodologies that bridge diverse domains of knowledge, fostering collaborative research and innovative solutions to complex, multi-dimensional problems. The interdisciplinary nature of data science

is essential in fostering collaboration between traditional academic fields and professionals with distinct skills.

Global overview of data science in interdisciplinary research

Globally, data science is transforming research across many disciplines by providing new methods for handling large, complex datasets. Machine learning (ML) and artificial intelligence (AI) algorithms are widely used to analyze health data, medical images, patient records, and genomic sequences. In the social sciences, data science is applied to analyze and understand human behavior through large-scale datasets, such as social media interactions, survey responses, and web traffic.

In engineering, data science facilitates the design and optimization of systems by analyzing vast amounts of data generated by sensors, simulations, and experiments. For example, in civil engineering, data-driven approaches are used to optimize traffic management, urban planning, and infrastructure monitoring. Similarly, in environmental sciences, data science is crucial for analyzing climate change data, modeling environmental impacts, and forecasting extreme weather events.

Data science and interdisciplinary collaboration

One of the primary benefits of data science in interdisciplinary research is its ability to create bridges between disparate fields. Data science methodologies allow researchers from different disciplines to collaborate by providing a common framework for understanding and analyzing data. Interdisciplinary research with data science often requires

a combination of expertise: domain knowledge of the subject matter, technical proficiency in data science techniques, and the ability to communicate findings across disciplines.

This type of collaboration helps to ensure that data models and algorithms are both scientifically valid and applicable to real-world challenges. For example, in the field of urban studies, data science is used to optimize city planning and infrastructure by analyzing urban mobility, energy consumption patterns, and resource usage. Researchers in urban studies work alongside data scientists to integrate real-time data from sensors and mobile devices, creating smart city solutions that enhance the quality of life in urban environments.

Data science in Vietnam: Opportunities and challenges

In Vietnam, the application of data science in interdisciplinary research is still in its early stages, but there are significant efforts underway to integrate data-driven approaches into various fields. Universities and research institutes are beginning to recognize the value of interdisciplinary research, and several initiatives aim to foster collaboration between data scientists and experts in other disciplines.

In the field of healthcare, the Vietnam Ministry of Health has begun leveraging data science to improve public health monitoring and response, particularly during the COVID-19 pandemic. Big data analytics were crucial for tracking infection rates, predicting the spread of the virus, and guiding health policy decisions (KPMG & Oxford University Clinical Research Unit, 2020).

Data science is also applied in medical research, with universities such as Hanoi Medical University using data-driven approaches to analyze patient data and improve diagnostic accuracy.

In education, interdisciplinary collaborations that combine data science with educational research are gaining momentum in Vietnam. For example, the University of Danang has initiated a project to use data analytics for improving educational outcomes by analyzing student performance and designing personalized learning plans based on individual learning patterns. However, these efforts face challenges, including a lack of trained personnel who can bridge the gap between data science and traditional disciplines.

Despite these efforts, several barriers remain to the full integration of data science in interdisciplinary research in Vietnam. One significant obstacle is the limited access to large datasets, which hinders the ability to conduct robust data-driven studies. Moreover, there is a need for more training programs that equip researchers with both the computational skills and domain knowledge necessary for interdisciplinary collaboration. Universities and research institutions must continue to invest in data science education and create environments that foster cross-disciplinary collaboration (Nguyen et al., 2021).

The future of data science in interdisciplinary research in Vietnam

The future of interdisciplinary research with data science in Vietnam looks promising, with several initiatives already underway to develop infrastructure and cultivate the necessary expertise. The Vietnamese government has recognized the

importance of Industry 4.0 technologies, including data science, in driving the country's economic and social development. As a result, there is an increasing focus on fostering collaboration between universities, research institutions, and industries to create a data-driven ecosystem.

Although data science is gaining attention in Vietnam's academic and applied research communities, several critical gaps continue to hinder its effective integration into interdisciplinary research. Existing partnerships are often ad hoc or project-based, lacking the institutional mechanisms and long-term strategies seen in global contexts. In Vietnam, however, the absence of dedicated data science hubs, limited policy support, and fragmented organizational structures have made it difficult to sustain cross-disciplinary efforts. This fragmentation reduces the potential for data science to contribute meaningfully to addressing complex societal issues in areas such as healthcare, education, and urban development.

In addition to collaboration challenges, Vietnam faces a shortage of interdisciplinary training programs that combine data science with domain-specific knowledge. While technical education in data science has expanded, many programs remain overly focused on computational skills without adequately addressing real-world applications in context-rich environments like public health or environmental studies. These gaps require coordinated efforts to promote open data initiatives, reform educational curricula, and build institutional capacity steps that are essential for Vietnam to fully harness the transformative power of data science in interdisciplinary research.

III. Research methods

Vietnam has made notable strides in integrating data science into interdisciplinary research, reflecting a broader commitment to innovation and sustainable development. A significant milestone is the collaboration between Nvidia and the Vietnamese government to establish an AI research and development center, along with an AI data center in Vietnam. This initiative aims to develop AI talent and digital infrastructure, highlighting the country's dedication to advancing in the field of data science.

Furthermore, the Vietnamese government's Statistical Development Strategy for 2021-2030 emphasizes the application of data science and big data technologies in statistical tasks. This strategy includes modernizing data collection and processing methods, aiming to provide statistical information that aligns with international standards. Despite these advancements, challenges persist, such as data quality issues, a shortage of skilled data scientists, and integration difficulties with legacy systems. Addressing these challenges is crucial for the effective implementation of data science in interdisciplinary research across Vietnam.

3.1. Infrastructure capacity and data ecosystem at higher education institutions

The development of interdisciplinary research in data science at Vietnamese higher education institutions is closely tied to the strength of their technological infrastructure and the maturity of their data ecosystems. Adequate infrastructure is essential to support data-intensive research and collaboration across

disciplines. However, a review of current conditions suggests that while some leading institutions have made progress, many universities across Vietnam still face significant limitations in these areas.

The construction of infrastructure for data science research is an essential foundation for implementing interdisciplinary research. Despite remarkable efforts, in general, the level of infrastructure investment for data science

at Vietnamese universities is still scattered and not synchronized. Some schools in the engineering and technology sector have built specialized data centers, while most of the facilities still depend on basic infrastructure, lacking interdisciplinary connections. Higher education institutions in Vietnam have data storage and analysis systems capable of serving medium-sized or larger interdisciplinary research, which are still very low (Parajuli et al., 2020).

Table 1. Types of universities with a data center and a data analysis lab

Types of Educational Institutions	Rate of Data Center	Rate of Data Analysis Lab
University of Engineering - Technology	65%	78%
University of Economic - Business	22%	39%
University of Medicine - Biology	18%	31%
University of Social Science - Humanities	9%	15%

Source: Vietnam Higher Education Development Report (2022)

A 2023 survey carried out by the Vietnam National University Information Center (VNUIC) revealed notable disparities in data infrastructure among Vietnamese universities. Only 27% of surveyed institutions reported having high-performance computing (HPC) capabilities

suitable for big data analytics or artificial intelligence research. Moreover, just 34% had formal data governance policies or dedicated research data repositories that align with FAIR (Findable, Accessible, Interoperable, and Reusable) data principles (Nguyen & Tran, 2023).

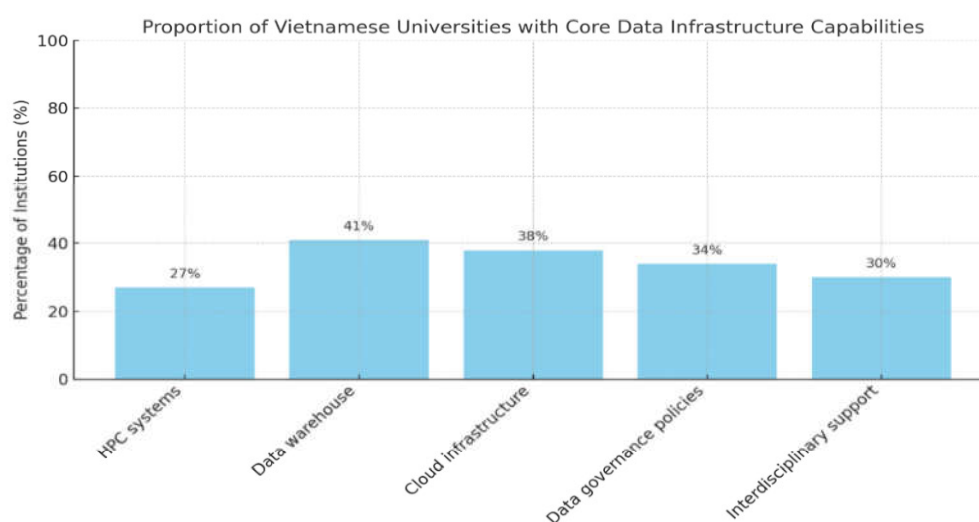


Figure 1. Vietnamese universities with core data infrastructure capabilities

Source: Nguyen and Tran, 2023

Beyond infrastructure, the ecosystem of data accessibility and sharing remains underdeveloped. Many institutions lack centralized data management systems or protocols to facilitate data sharing across departments. Data silos are common, and the absence of national-level open data frameworks further constrains collaborative, cross-sectoral research. In contrast, international models such as the European Open Science Cloud (EOSC) and the NIH Data Commons in the U.S. provide platforms that promote interdisciplinary research through open and well-governed data ecosystems (European Commission, 2019; National Institutes of Health, 2018).

Government support through initiatives like the National Digital Transformation Program (Decision 749/

QĐ-TTg) offers a pathway to align university infrastructure with national digital strategies. However, without targeted funding and coordinated implementation, progress may remain uneven. In summary, the current state of infrastructure and the data ecosystem at Vietnamese universities presents both challenges and opportunities.

3.2. Current situation of interdisciplinary scientific publication using data science

According to analysis from the Scopus database, in the period 2018-2023, Vietnam has a total of 4,832 articles related to “data science”, of which only about 6.2% have obvious interdisciplinary elements (for example, combined with medicine, sociology, environment, economics).

Table 2. Ratio of IDR in Data Science research in Vietnam

Year	Total Number of Data Science Research Papers	Total Number of IDR	Ratio (%)
2018	412	23	5.6
2019	587	31	5.3
2020	779	48	6.2
2021	925	58	6.3
2022	1001	64	6.4
2023	1128	78	6.9

Source: EduRank (2025)

Interdisciplinary scientific publications using data science have experienced notable growth in recent years, particularly in fields such as public health, environmental science, economics, and engineering. The integration of data analytics, machine learning, and computational modeling into domain-specific research has enabled Vietnamese scholars to tackle complex problems with greater precision and insight. According to a 2023 report by the Vietnam Institute for Advanced Studies in Mathematics (VIASM), the number of

interdisciplinary publications involving data science has grown by nearly 190% between 2018 and 2023.

This increase is attributed to a combination of factors, including international research collaborations, increased availability of open data, government initiatives promoting science and technology, and growing institutional awareness of the value of interdisciplinary methodologies (Pham & Nguyen, 2023). The following table summarizes the trend over the past six years:

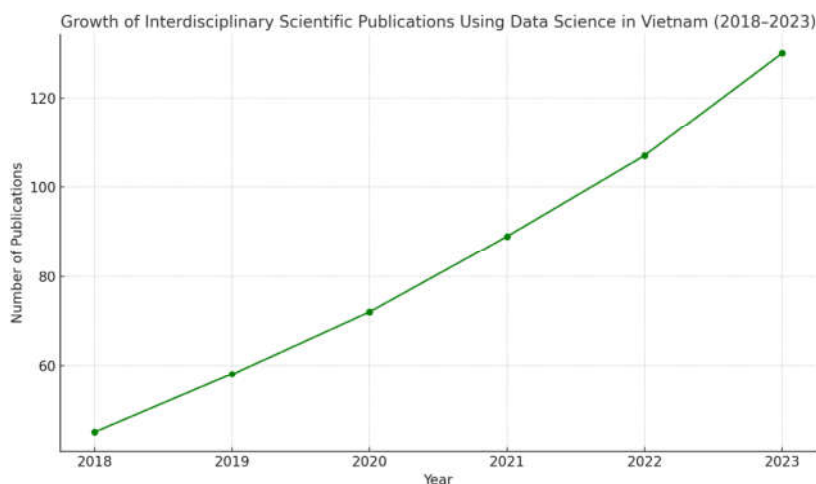


Figure 2. Growth of IDR scientific publications in Vietnam (2018-2023)

Despite the encouraging trend, a significant proportion of interdisciplinary research is concentrated within a few major institutions such as Vietnam National University, Hanoi University of Science and Technology, and Ho Chi Minh City University of Technology. Smaller universities and regional institutions often lack the capacity and incentives to pursue cross-disciplinary research. Furthermore, while the volume of publications has

increased, concerns persist regarding research quality, impact factor, and international visibility (Do & Tran, 2022).

To ensure sustainable progress, policy interventions are needed to support faculty training, international publishing capacity, and cross-sectoral funding mechanisms. Collaborative platforms, national research repositories, and partnerships with industry may further enhance the scope and quality of such work.

3.3. Modeling factors influencing interdisciplinary research using data science

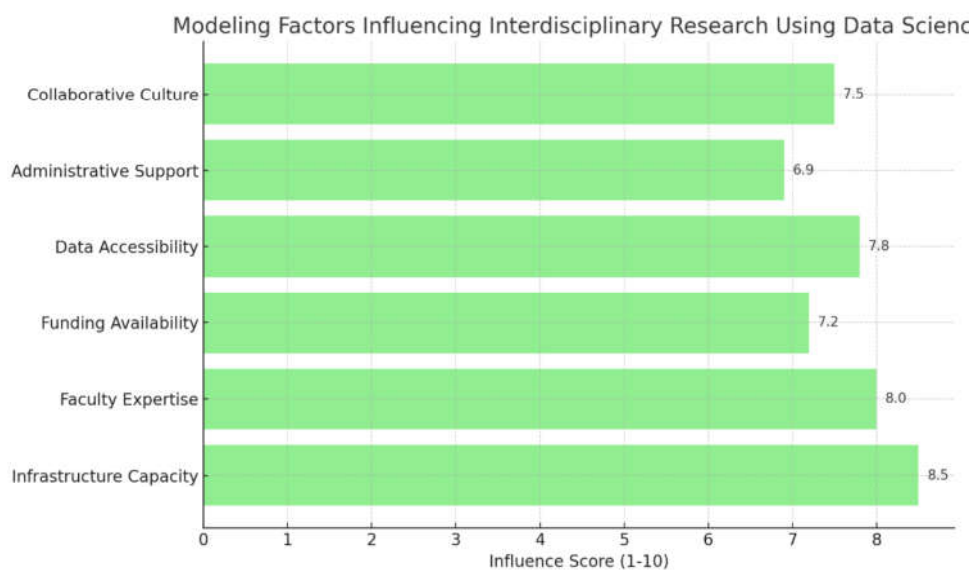


Figure 3. Key factors influencing IDR using data science in Vietnam

Source: Nguyen and Tran, 2023

Based on a synthesis of existing literature, several core factors have been identified as influential in enabling or constraining interdisciplinary collaboration: infrastructure capacity, faculty expertise, funding availability, data accessibility, administrative support, and organizational culture (Wagner et al., 2011; Nguyen & Tran, 2023). A scoring model was developed based on a composite index from expert survey responses across Vietnamese universities ($n = 32$). Participants rated each factor on a scale from 1 (very low influence) to 10 (very high influence) in the context of promoting interdisciplinary research using data science.

The results show that infrastructure capacity and faculty expertise are viewed as the most influential enablers. This reflects the need for high-performance computing, research platforms, and skilled personnel. Recently, data accessibility and collaborative culture have also played significant roles in open data initiatives and supportive academic environments that encourage knowledge-sharing and joint research. On the other hand, administrative support and funding availability scored lower, indicating gaps in institutional incentives, research management, and targeted investment. Improving these influencing factors, particularly through national investment programs and institutional policy reform, will be crucial in accelerating the growth of interdisciplinary research using data science in Vietnam.

IV. Discussion

To advance interdisciplinary research using data science in Vietnam, it is essential to establish a clear strategic orientation accompanied by practical

recommendations. Therefore, higher education institutions must develop structured approaches that foster collaboration, strengthen infrastructure, enhance human capital, and ensure sustained policy support.

Building robust data ecosystems

A fundamental strategy for promoting interdisciplinary research in data science is the development of robust data ecosystems. Establishing national data repositories and open data platforms is crucial to facilitating data sharing across academic and professional boundaries. These systems should comply with ethical standards and data governance regulations, including maintaining data quality and ensuring privacy. As highlighted by Nguyen and Tran (2023), the lack of centralized data management hampers effective collaboration. Therefore, adopting comprehensive data governance frameworks is imperative to encourage the use of shared data across disciplines, while also maintaining data integrity and accessibility.

Fostering interdisciplinary collaboration

Promoting collaboration between data scientists and domain experts requires creating structured and sustainable frameworks. One effective approach is the establishment of research hubs that actively integrate data science with domain-specific knowledge. These hubs should function as innovation centers where researchers from diverse fields work jointly on common challenges. Sustained collaboration is more achievable when institutions support joint appointments, cross-disciplinary training, and ongoing knowledge exchange. Additionally, forming partnerships with industry is vital

to ensure that research remains relevant and directly applicable to societal needs. Aligning academic research agendas with practical applications through industry collaboration will significantly enhance the impact of interdisciplinary projects.

Developing human capital

Human capital development is pivotal in ensuring that interdisciplinary research involving data science can thrive. Higher education institutions must integrate data science training into curricula beyond technical fields. By offering interdisciplinary programs that merge data science with healthcare, social sciences, environmental studies, and engineering, universities can cultivate a new generation of professionals proficient in both computational techniques and domain-specific knowledge. As Wagner et al. (2011) noted, equipping researchers with dual expertise fosters more meaningful collaborations and better problem-solving capabilities. Moreover, continuous professional development through workshops and certifications will help current researchers adapt to evolving data science methodologies.

Investing in infrastructure

Upgrading digital infrastructure is essential to support the demands of data-intensive interdisciplinary research. This involves enhancing high-performance computing (HPC) facilities, expanding cloud-based research environments, and ensuring that data storage solutions are secure and scalable. As emphasized by the Vietnam Ministry of Education and Training (2022), universities must prioritize the establishment of computational clusters and online collaboration platforms that facilitate seamless data processing and

analysis. Investing in infrastructure not only empowers researchers but also positions universities as leaders in the digital transformation of education and research.

Securing funding and policy support

Adequate funding and strategic policy support are necessary to sustain interdisciplinary initiatives. Government agencies and higher education institutions should implement grant schemes specifically targeting interdisciplinary research projects involving data science. Furthermore, policies that incentivize cross-disciplinary collaborations through joint funding applications can enhance the research landscape. Establishing dedicated funding streams will alleviate financial constraints, enabling institutions to invest in both human resources and technological advancements. Additionally, creating clear guidelines for interdisciplinary project evaluation will ensure that funding is allocated efficiently and aligned with strategic research goals.

Implementation roadmap and evaluation

To translate these strategies into actionable steps, a phased implementation approach is recommended. In the short term (1-2 years), universities should focus on developing data governance policies, piloting interdisciplinary training programs, and establishing initial collaborative hubs. In the medium to long term (3-5 years), expanding interdisciplinary curricula and forming strategic partnerships with international research institutions will be essential. Regular monitoring and evaluation should be conducted to assess progress, focusing on metrics such as research output,

collaboration quality, and infrastructure utilization. By continuously refining these strategies, Vietnam can create a sustainable model for integrating data science into interdisciplinary research.

V. Conclusion

In conclusion, while Vietnam has made significant strides in integrating data science into interdisciplinary research, considerable challenges remain in building an environment conducive to cross-disciplinary collaboration. To achieve sustainable progress, Vietnam must prioritize the development of robust digital infrastructure, enhance the training of researchers skilled in both data science and domain-specific knowledge, and foster collaborative research networks. Strategic policy support, including funding mechanisms and institutional reforms, will be essential for realizing the full potential of data science in addressing the country's complex issues. By strengthening these areas, Vietnam can position itself as a leader in interdisciplinary research, harnessing data science to tackle the pressing challenges of the digital age and contributing meaningfully to global scientific advancements.

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THÚC ĐẨY NGHIÊN CỨU LIÊN NGÀNH VỚI KHOA HỌC DỮ LIỆU TẠI CÁC TRƯỜNG ĐẠI HỌC VIỆT NAM: THỰC TRẠNG VÀ ĐỊNH HƯỚNG

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Tóm tắt: Tích hợp khoa học dữ liệu vào nghiên cứu liên ngành (IDR) đã trở thành nền tảng trong việc giải quyết các thách thức toàn cầu phức tạp, đặc biệt trong thời đại số. Tại Việt Nam, mặc dù tiềm năng của khoa học dữ liệu ngày càng được công nhận, việc tích hợp lĩnh vực này vào nghiên cứu liên ngành vẫn đang ở giai đoạn sơ khai. Bài báo này khảo sát thực trạng nghiên cứu liên ngành ứng dụng khoa học dữ liệu tại các trường đại học Việt Nam, đồng thời xác định những thách thức và cơ hội. Nghiên cứu nhấn mạnh vai trò của phát triển hạ tầng, nguồn nhân lực và khung hợp tác trong việc thúc đẩy khoa học dữ liệu xuyên suốt các ngành học. Bài viết cũng đưa ra các khuyến nghị chiến lược nhằm xây dựng hệ sinh thái nghiên cứu dựa trên dữ liệu, đảm bảo sự phát triển bền vững và nâng cao năng lực cạnh tranh toàn cầu. Cuối cùng, bài báo đề xuất các bước hành động cụ thể để Việt Nam từng bước trở thành quốc gia dẫn đầu trong nghiên cứu liên ngành ứng dụng khoa học dữ liệu, đóng góp vào việc giải quyết các vấn đề xã hội cấp bách.

Từ khóa: hợp tác học thuật, khoa học dữ liệu, nghiên cứu liên ngành, hợp tác liên ngành, nghiên cứu đại học

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